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High risk of urinary tract infections in post-operative gynaecology patients: A retrospective case analysis

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Abstract

This study was undertaken to determine the incidence and risk factors related to the occurrence of urinary tract infections (UTI), post surgery, in women being treated for a gynaecologic cancer. A retrospective case analysis of 215 women was conducted using data collected via case review with domains covering known risk factors for the occurrence of urinary infections. Bacteriuria was defined as greater than 10^5 colony-forming units per millilitre. 30.7% of women had a UTI postoperatively. 75.7% infections were *Escherichia coli*. Having a catheter *in situ* for ≤ 3 days was found to be slightly significant in the formation of a UTI postoperatively, $U=3878$, $p<.05$. Having a catheter *in situ* for ≥ 7 days was found to be highly significant, ($\chi^2(1) = 6.602$, $p<0.01$), OR= 2.44. A positive correlation was found between the duration of the catheter *in situ* and type of UTI ($\tau=.251$, $p<.01$). Although urinary catheterisation is known to be related to hospital acquired infection, a shorter duration of catheterisation may reduce the risk of possible infection post surgery. Oncology teams need to be more aware of this risk, identify women more likely to be catheterised for longer and use preventative strategies for managing infection, such as silver nitrite lined catheters.

Key words: Gynaecologic cancer, oncology, urinary tract infections, case review, surgery, complications.

Body of text

Introduction

Hospital acquired infections (nosocomial infections or healthcare associated infections [HCAIs]) are defined as “infections acquired in hospital likely to complicate illness, cause anxiety and discomfort and can lead to death” (NINSS 2002) or infections acquired “as a result of health care interventions” (HPA 2009). The results of the Third Prevalence Study of healthcare infections in England conducted in 2006 showed that urinary tract infections (UTIs) were among the most common health care associated infections (Smyth et al, 2008). UTIs accounted for 19.7% of total healthcare associated infections second only to gastrointestinal infections. HCAIs also carry substantial cost implications for the health service in the additional bed days and costs of medication. It is estimated that HCAIs will cost the NHS £124 million per year and cost approximately £1327 per infection (Plowman et al, 1999).

It is good practice that prevention of nosocomial infections should be a priority for health care professionals as infection increases the morbidity and mortality of patients. The occurrence of a UTI combined with increased age, severity of underlying disease, type of hospital service (medicine/general surgery) and duration of catheterisation have been found to be significantly correlated with increased morbidity and mortality in patients (Platt et al, 1982, Saint, 2000). In a review of the literature, the risk factors for a UTI were found to be a past history of UTIs, history of diabetes mellitus, postmenopausal, history of urinary tract

abnormalities (such as a cystocele or rectocele), frequent sexual intercourse, use of a diaphragm with spermicide, renal problems, bladder problems and pregnancy (Hu et al, 2004, Boyko et al, 2005, Car and Sheikh, 2003, Sheffield and Cunningham, 2005)

Women being treated for gynaecological cancer often have these characteristics and a long period of catheterisation. Surgery is one of the main treatment options for women with gynaecological cancer and catheterisation is a seemingly unavoidable part of this process as it aids postoperative voiding dysfunction caused by “anaesthesia, analgesia and immobility” (Wald et al, 2008a). The objective of this study was to determine risk factors for women undergoing gynaecological cancer in relation to UTI occurrence. An understanding of the risk factors for UTI in this population can improve risk assessment and will improve practice and ultimately improve patient outcome.

Methods

This study was a retrospective review of 215 medical notes to determine the risk factors for the development of UTIs in the gynaecologic oncology patient group. We also sought to develop a risk assessment tool to enable the speedy identification of high risk individuals and implementation of improved practice to decrease the incidence of a UTI.

The researcher obtained a list of the details of women who had undergone gynaecological surgery for cancer in the years 2004 to 2005 at a large regional cancer centre within the UK. (See Fig. 1 for patient selection). 147 patients were excluded from the retrospective medical notes review as their procedures did not involve intraoperative and /or postoperative catheterisation.

Fig. 1 Selection of study subjects

Ethical approval for this study was sought from the University Ethics Committee. Document agreement to conduct this study was obtained from the head of the Gynaecology Department and the Clinical Audit and Effectiveness department of the Trust. The proposed retrospective medical record review was assessed against the ethical principles for research, clinical audit and service review projects outlined by the Trust. All ethical principles were met.

The proforma used for the retrospective medical notes review was based on the risk factors and the most common UTIs identified in the literature review. The microbiological laboratory of the Trust defined a UTI as a midstream sample or a catheter specimen sample of urine having a bacterial count of $>10^5$ colony-forming units per millilitre (cfuml⁻¹). This definition of bacteriuria may underestimate the incidence of UTIs in this high risk population (Stamm et al, 1982, Hamilton-Miller, 1997, Hooton, 2001, Dwyer and O'Reilly, 2002) in oncology centres lower values are used to report UTIs but surgery is often conducted in general settings.. From nursing and medical documentation, a patient's urine sample was only sent if women showed signs or symptoms of an infection, for example, burning on micturation, pyrexia and/or abdominal pain.

To ensure external validity, the proforma was submitted for review by medical staff and nursing staff in the differing departments of the Gynaecology directorate to determine if all possible factors for urinary tract infection were covered. The relationship between categorical variables and the significance of this relationship were analysed using cross tabulations against the incidence of urinary tract infection. Pearson's chi-squared test (χ^2), Cramer's V, Mann Whitney U (MWU), and bivariate correlations, for example, Kendall's Tau (τ) were undertaken, as appropriate, to determine the significance of the findings. Data was analysed using SPSS v15 (SPSS Inc 2006, Chicago, IL, US).

Results

The mean age of the women in the sample was 62 years. The age range of the sample was 20 years to 88 years. The ratio of premenopausal to postmenopausal clients was 1:5 (16.3% vs. 83.7%). Four types of cancer were found in the sample. 39.5% of the population (n=85) had endometrial cancer, 37.2% (n=80) had ovarian cancer, 12.1% (n=26) had vulval cancer and 11.2% (n=24) had cervical cancer (Table 1).

Table 1: Overview of the population in terms of the risk factors denoted in the literature

Rates and types of infection

30.7% (n=66) of the women had a postoperative UTI. Of this 66, *Candidia* accounted for 3% (n=2) of infections, *Coliform* for 13.6% (n=9), *Citrobacter freundii* for 1.5% (n=1), *Enterobacter spp.* for 1.5% (n=1), *Escherichia coli (E.coli)* for 75.7% (n=50), *Proteus* for 3% (n=2), *Pseudomonas aeruginosa* for 9% (n=6) and *Staphylococcus aureus* for 3% (n=2). Some women developed more than 1 infection during their admission. Although more procedures were conducted in 2005 [54% (n=116)], results show that there were marginally more infections for the year 2004 than for 2005 [54.5% (n=36) vs. 45.5% (n=30)].

The mean age of the population that developed a postoperative UTI was 63.4 years. 41% (n=27) had ovarian cancer, 36% (n=24) had endometrial cancer, 12% (n=8) had cervical cancer and 10% (n=7) had vulval cancer. 82% (n=54) were postmenopausal and 18% (n=12) were premenopausal. Of the 89.8% (n=193) of the sample that had antibiotics intraoperatively, 79% (n=169) had intravenous Coamoxiclav (ampicillin/amoxicillin) 1.2g. 0.9% (n=2) of the women did not have prophylactic antibiotics intraoperatively as they were on antibiotics preoperatively. One patient was on long-term antibiotics. The second patient

had completed a course of antibiotics for a UTI immediately prior to surgery. There was no documentation of intraoperative antibiotics for 9.3% (n=20) of the sample.

Contributory factors to the occurrence of urinary tract infections

The key factors found to be a contributory factor for UTI were explored in the analysis: age, type of cancer being treated, menopausal status, history of diabetes, combined history of UTI, renal disease, uterine prolapse and urinary abnormalities, BMI and the presence of a UTI preoperatively. Despite these identified in the literature as possible risk factors, these were not found to be significant risk factors for the formation of a postoperative UTI in the women.

There were a greater proportion of postmenopausal women to premenopausal women in the sample (n=180 vs. n=35). Subsequently, 82.8% of postoperative UTIs were found in the postmenopausal group. A statistical correlation between the type of uropathogen and menopausal status was deemed inappropriate due to small numbers in this subgroup. A small percentage of the women had a history of diabetes (13.1%) and only 3.8% of these women were diagnosed (positive urine culture) with a UTI postoperatively. Although data was combined for history of UTI, renal disease, uterine prolapse and urinary abnormalities, only 5.6% of the population had one or all of these co-morbidities. Only 2 women had a catheter in situ preoperatively and 1.9% of the population had a UTI preoperatively and postoperatively. 35.5% (n=60) of women who had Coamoxiclav (ampicillin/amoxicillin) intraoperatively went on to develop a postoperative UTI. 70% (n=42) of those infections were due to *E. coli* and 38.1% (n=16) of these infections were resistant to amoxicillin.

Unsurprisingly the duration of catheterisation was found to be the most significant factor in relation to UTI incidence. Having a catheter in situ for 7 days or more was found to be highly significant ($\chi^2(1) = 6.602$, $p < 0.01$), with an odds ratio of 2.44. The presence of a catheter for 0-3 days increased the risk of UTI formation as compared to 4-6 days ($U = 3878$, $p < .05$, (mean ranks 112.97 vs. 93.09). Furthermore the duration of catheterisation was positively correlated with the type of uropathogen ($\tau = .251$, $p < .01$). *E. coli* accounted for 21.5% of UTIs for days 0-3, 29.6% for days 4-6 and 31.6% for the ≥ 7 day group.

Discussion

Thirty-one percent (31%) of the sample population was found to have a postoperative UTI, suggesting that this is a common complication post therapy. The Third Prevalence Survey for healthcare associated infections conducted in acute hospitals in 2006 found that 19.7% of the total healthcare associated infections were attributable to urinary tract infections (Smyth et al, 2008). A sub-analysis of the types of uropathogens encountered and the inclusion or exclusion of surgical oncology patients in this survey was not included.

Past research studies have found that *E. coli* was the predominant uropathogen involved in catheter associated urinary tract infections (CAUTIs) (Wazait et al, 2003, Kucheria et al, 2005). Their findings are quite similar to the findings of this study where *E. coli* accounted for 75.7% of infections, *Proteus* accounted for 3%, *Coliforms* accounted for 13.6% and *Pseudomonas aeruginosa* accounted for 9% of infections (some clients had more than 1 infection). Urethral epithelial cells can be normally colonised by *Escherichia spp.*, *Klebsiella spp.*, *Proteus spp.*, *Corynebacterium spp.*, *Staphylococcus spp.*, and *Candida spp.* (Madigan et al, 2000). However, pathogenic infection can occur as a result of decreased immunity which may occur in cancer patients as a result of the disease or treatment. Perioperative stress has also been shown to result in immunosuppression and increased risk of postoperative infection (Hebert et al, 1999). This study may have under represented the

number of infections due to the higher threshold used by general hospitals in measuring infection.

UTIs potentially cost health services approximately £19,500,000 per year (Plowman et al, 1999, Smyth et al, 2008). Furthermore the psychological cost to the patient and their family is difficult to measure but could result in decreased mobility and delay in discharge. The synergistic effect of co-occurring symptoms may affect patient outcomes (Dodd et al, 2004), for example a reduction, delay or discontinuation of treatment. This can add additional symptoms and discomfort at a time of anxiety for such women.

The risk factors for postoperative UTI in the sample population were examined and found to be duration of catheterisation. The odds ratio predicted that an individual was 2.44 times more likely to develop a UTI postoperatively if they were catheterised for 7 days or more, which is supported by the literature (Shapiro et al. 1984).

The literature search did not suggest that catheterisation up to 3 days was a factor in the formation of a UTI. However, a previous study (Wad et al, 2008a) found that patients catheterised for 2 days or more had double the likelihood of developing a UTI than those catheterised for 2 days or less. This study found that 23% of catheterisations from 0-3 days resulted in a postoperative UTI. This was significant at $p < .05$. Approximately 80% of nosocomial UTIs are due to indwelling catheters (Plowman et al. 2001). Prior studies highlight that the risk of developing bacteriuria can increase by 5% for each day catheterised (Garibaldi et al, 1974, Schaeffer, 1986) and in one study (Garibaldi et al, 1974) 50% of patients developed bacteriuria after the tenth catheterised day. The data from this study supports the concept of accumulating risk of infection which is caused by catheterisation. Reducing the number of days that women are catheterised could have a substantive affect on reducing infection.

Reducing the use of urinary catheters is not easy in practice. Catheterisation is a fundamental part of gynaecological surgery as it aids postoperative bladder dysfunction (postoperative retention, frequency and hesitancy). Patient mobility can decrease due to prolonged catheterisation (Saint et al, 1999) but conversely patients remain catheterised due to this decreased mobility (Wald et al, 2008b). In light of the results of previous research and the findings of this study, removal of catheters at day 2 would be advantageous taking into account the patient's "wellness" at the time of decision making.

Risk assessing women prior to surgery and that with such surgical procedures catheter removal at day 2 is unlikely, the use of the silver alloy catheters may help in reducing the subsequent risk of urinary tract infection. Silver, being a non-toxic prominent broad spectrum antimicrobial has been shown to be effective against urinary infective agents, such as, *Escherichia coli* (Sondi and Salopek-Sondi, 2004, Davenport and Keeley, 2005). There is good evidence for the use of silver alloy catheters (Karchmer et al, 2000, Lai and Fontecchio, 2002) but are often not used at point of surgery because of higher costs. Healthcare professionals need to be able to identify those women at higher risk of prolonged catheterisation and take effective action to reduce risk.

Another risk reducing measure is health education. This applies to all stakeholders, the patient, carers and healthcare professionals. National infection control guidelines emphasise the importance of personal hygiene, catheter care and patient and carer education (NICE, 2003). Yet past (Bridger, 1997) and present (Wagg et al, 2005, Foxley, 2008) studies continue to show that nursing knowledge about catheter and catheter care was less than should be expected. Few women in this study had assessment of risk identified in their records.

A UTI risk assessment tool as a result of this study has been formulated, taking into account the risk factors highlighted in and those identified in this study (Figure 2). Risk assessment is important in reducing infection and in planning future care.

We acknowledge that there are some limitations in reviewing cases from one NHS trust and that this was a relatively small sample for a risk analysis. This was a retrospective study and therefore reliant on good documentation with an adhoc approach to detecting urinary tract infections. This study has confirmed that increased duration of catheterisation is a substantive risk factor contributing to the incidence of UTI, and confirms the findings of other studies. It has also highlighted the significance of the elevated risk caused by catheterisation for 7 days or more, to the gynaecologic patient group.

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Legends for figures and tables

Table 1 Overview of the population in terms of the risk factors denoted in the literature

Figure 1 Selection of study subjects

Figure 2 UTI risk assessment tool

Table 1: Overview of the population in terms of the risk factors denoted in the literature.

FACTORS	FREQUENCY(n)	PERCENT (%)
n=215		100%
Age	Mean 61.67years Range 20-88	
<u>Body Mass Index (BMI):</u>	Median 28 Range 15-63.5	
BMI<18.5	2	0.9
BMI=18.5-25	56	26
BMI=25-30	65	30.2
BMI>30	77	35.8
BMI Not recorded	15	7.1
<u>Cancer:</u>		
Cervix	24	11.2
Endometrium	85	39.5
Ovary	80	37.2
Vulva	26	12.1
<u>Menopausal status:</u>		
Premenopausal	35	16.3
Postmenopausal	180	83.7
History of diabetes	29	13.5
History of UTIs	14	6.5
*History of co-morbidities	22	10.2
History of uterine prolapse	16	7.4
<u>Catheter:</u>		
Preoperatively	5	2.3
Intraoperatively	213	99.1
Postoperatively	213	99.1
Catheter in situ>7days	39	18.3

*History of co-morbidities include renal disease, bladder cancer, bowel cancer, breast cancer, ovarian cancer, cerebrovascular accident, urinary tract abnormalities.

Fig. 1: Selection of study subjects

Fig. 2: UTI risk assessment tool